Chapter 19
An Investigation into Mobile Learning for High School Mathematics

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ABSTRACT
This paper describes an investigation which was carried out to determine if mobile learning can be used to help high school students improve their performance in mathematics. The investigation was driven by the need to develop innovative learning solutions to eradicate the problem of low pass rates in mathematics in the Caribbean. A mobile learning application called MobileMath was developed targeting a subset of the mathematics curriculum. MobileMath offers the learner different learning strategies, game-based learning, and personalization. Two of the evaluation studies conducted are described in this paper. The first study focused on students using mobile learning on their own, while the second study explored the effects of teacher support while using mobile learning. A t-test analysis shows that there was a significant improvement in performance by students in both evaluation studies. The paper also compares the students’ performance with actual usage of the mobile learning application.

INTRODUCTION
This paper presents a mobile learning investigation conducted in Trinidad and Tobago, which aimed to determine if mobile learning can assist students to improve their performance in mathematics. The investigation was driven by the need to develop innovative learning solutions to eradicate the problem of low pass rates in secondary school mathematics in the Caribbean. After reviewing the literature on learning technology for mathematics we designed and developed a mobile learning
application with several features to appeal to the target students.

Next, we conducted several studies to evaluate the mobile learning application. Two of these studies are highlighted in this paper. In the first study, students were allowed to use the mobile learning application without teacher intervention. The objective of this first study was to determine if students would choose to use mobile learning without teacher intervention. In the second study, the students were encouraged to use the mobile learning application by a teacher. The objective of the second study was to determine if the students would use mobile learning more with teacher support and encouragement. The results of the first study are compared to that of the second study to understand the effects of teacher encouragement on student use of the mobile learning application.

The paper also discusses the effects of learning strategies deployed in the mobile learning application. These include games-based learning and personalization. Various statistical analyses are performed to show the results of the evaluation studies. The paper also discusses some of the challenges experienced in carrying out our research with mobile learning for mathematics. Finally, the paper concludes with some suggestions for future research.

**BACKGROUND**

This study was motivated by the problem of high failure rates in mathematics in the Caribbean. In the last six years the average pass rate of the Caribbean Examination Council (CXC) mathematics examination (an examination taken by most high school students in the English-speaking Caribbean) was 41%. This examination is made up of Paper 1 and Paper 2. Paper 1 is a multiple choice examination and Paper 2 is the more extensive examination requiring detailed answers and is thus a better indicator of high school mathematics proficiency. Figure 1 illustrates the percentage of students who passed Papers 1 and 2 in the last six years. It shows that for each year, the pass rate was much lower for Paper 2 than Paper 1. The average pass rate for Paper 2 is 22%.

This data reveals that, on average over the last six years, almost 80% of the students in the Caribbean failed Paper 2 of the CXC mathematics examination and 60% were awarded passing grades. This is convincing evidence that there is a need for innovative learning tools for mathematics in the Caribbean (Caribexams, 2004).

The mobile phone is one of the most ubiquitous technologies today. It is appealing to a large sector of the population, especially young people. It is also affordable and the infrastructure is widely available.
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